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## CHAPTER 6

# Human Resources

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The metalcasting industry realizes that, in addition to its customers, its chief asset is its employees. The industry cannot hope to achieve its vision without trained people in sufficient numbers. Metalcasting workers must not only be willing to perform demanding tasks, but they must also have a relatively high level of educational and work skills. The skills of tomorrow's foundry workers will require more than a simple understanding of metalcasting. The demands of future product needs will require employees to maintain a constant awareness of technological developments over a wide range of disciplines. This will allow the industry to remain competitive with foreign metalcasters as well as alternatives to castings.

### Current Situation

There is presently a shortage of skilled labor in the U.S. metalcasting industry. Early retirements and staff reductions in response to depressed market conditions, as well as low levels of hiring, have resulted in a shortage of experienced technical, management, and supervisory people. The average age of diemakers, patternmakers, and other craftsmen in the United States is over 50 years. The attrition rate of experienced engineers far exceeds the number of new engineers entering the metalcasting industry.

Foundry programs have been dropped or de-emphasized by all but a handful of engineering schools. The number of undergraduate engineering students choosing foundry technology as a major course of study has decreased dramatically, while the lack of industry support for graduate research work in metalcasting has created a low turnout of graduate engineers interested in entering the metalcasting industry. There is also a concern that the vocational (high school) side of the industry has been neglected. Few high schools have vocational arts programs that teach metalcasting skills or any other programs that match the needs of the industry.

In terms of continuing education of the existing workforce, U.S. foundry workers on the average receive less technical training each year than their counterparts in Germany, Japan, and Korea. Compared to major foreign competitors, U.S. foundry workers have lower participation rates in apprentice programs that teach skills such as patternmaking and diemaking, which require significant hands-on training and practice.

Numerous educational activities aimed at the metalcasting industry workforce are sponsored by the industry trade associations as well as others. A number of state programs are in place that are designed to offer training and introduce new technologies to small and medium-sized companies. The metalcasting industry trade associations sponsor conferences, workshops, continuing education courses and in-plant training, and publish newsletters, resource books, brochures and other documents to keep members informed. Some specific outreach efforts include:

- C The American Foundrymen's Association's abstract search and retrieval system for answering technical questions
- C The Casting Industry Suppliers Association's on-line electronic program to assist metalcasters in the rapid selection of advanced equipment and products
- C The North American Diecasting Association's die-casting database for die casters and customers, a fax-on-demand system to transfer information to industry, and a simulation program for use in training
- C The Steel Founders' Society of America's series of videotapes for educating design engineers on steel castings

In addition, the University of Northern Iowa, through the Metalcasting Manufacturing Technology Center project, has been training design engineers from the U.S. Department of Defense and commercial companies on designing with metalcastings.

## Trends and Drivers

Metalcasters believe that the quality of foundry employees will play a major role in controlling the rate of change in the industry. Other industries that are more attractive will capture the best available employees. With the demographics of an aging workforce, the metalcasting industry will have to scramble to attract skilled and qualified people. Tomorrow's workers won't possess the hands-on skill of earlier generations of workers.

The nature of the jobs available to future employees will also be different. This will be the case by design - through process reengineering, for example -- and also as technology continues to create or recreate jobs.

## Performance Targets

Renewed emphasis on human resources, education, and training will enable the U.S. metalcasting industry to:

- C Attract sufficient talent to the industry
- C Keep present employees current with latest technologies and techniques

## Barriers

The barriers to improving the caliber of the metalcasting industry workforce are shown in Exhibit 6-1. A smaller pool of employees at all levels will make **attracting skilled employees** a key issue. The metalcasting industry is considered relatively "low-tech" and unglamorous, hurting its ability to attract young people. The work and educational skills of entry-level personnel are considered inadequate by most metalcasters. In general, many high school graduates and potential entry-level employees are felt to lack the basic education needed to function in a manufacturing environment.

Exhibit 6-1. Major Human Resources Barriers	
AREA	BARRIERS

<b>Availability of Skilled Employees</b>	<p>“Low-tech” image of the industry</p> <p>High school graduates lack the basic education and skills needed to function in a manufacturing environment</p> <p>Lack of experienced personnel</p> <p>Shortage of engineers skilled in computer science who wish to work in the metalcasting industry</p> <p>Difficulty finding and hiring willing and qualified employees to work in the metalcasting industry</p>
<b>Technical Training/Information Transfer</b>	<p>Insufficient knowledge of metal castings as viable design components</p> <p>Lack the resources to send employees to training programs</p> <p>Public training programs not geared to needs of small metalcasting companies</p> <p>Reductions in technical staff by vendors has reduced the flow of information to metalcasters</p> <p>Poor connection between academia and manufacturing</p> <p>View that information transfer and education are not cost-reducing or productivity-enhancing measures</p>

At a higher level, there is an acute shortage of engineers who wish to work in the metalcasting industry and are trained in the interdisciplinary fields of computer science and engineering. Few people with critical technical and production experience are available.

The combination of fast changing technology, economic pressure, and the poor connection between academia and manufacturing diminish the **information transfer** process. For example, there is insufficient knowledge of castings as viable design components throughout the design community and in engineering schools.

Metalcasting companies, particularly smaller ones, view information transfer and education from a problem-solving perspective and not as cost-reducing or productivity-enhancing measures. Small individual metalcasting companies often lack the resources to send employees to training programs, placing them at a serious competitive disadvantage. Past industry downsizing, coupled with an increase in business activity, has intensified the problem of staff being off the job for training. Smaller companies tend not to participate in public training programs, largely because such programs are generally not geared to their needs. In addition, reductions in technical staff by vendors has reduced the flow of information to metalcasters, especially smaller companies.

## Integration with the Technology Roadmap

The operating philosophy of the metalcasting industry will continue to be “change” as dictated by the technology, environmental, and competitive pressures of the industry. This operating philosophy will demand higher levels of problem solving abilities, technology, knowledge, skills, and even new attitudes. Engineers, chemists, metallurgists, technicians, and craftsmen of all types are needed throughout the industry to meet the challenges presented by advanced equipment, new processes, and the production of complex cast parts. Increased education of the industry’s workforce will help the industry achieve and maintain a competitive advantage. For example, a more skilled and knowledgeable workforce will be able

to envision more new product applications and will be quicker to adapt to process changes and new manufacturing technologies.

The industry believes that education is the most effective way to address its future human resource challenges. Continued educational programs of various types are needed for the industry to prosper; the industry sees these programs as among the wisest investments it can make.

In addition to worker education and training, new mechanisms of technology transfer must be developed and employed to keep foundries up to date with information on new manufacturing technologies and processes, new alloys and other casting materials, and casting design and material property data. This is especially critical for small and medium-sized foundries who typically lack the resources to take advantage of traditional technology transfer methods. The metalcasting industry will also have to take advantage of the education, training, and information transfer capabilities of the metalcasting associations, vendors, universities, national laboratories, consultants, and government agencies.

Current information transfer approaches need to be restructured to account for the industry's diversity. Diversity among metalcasting organizations is key when assessing information transfer, education, and training objectives. This diversity includes industry variables such as company size, types of technology utilized, number and sophistication of staff, and geographical distribution. Implicit in these variables is the ability to devote time and money to implementing the technology needed to successfully cope with problems.

Some specific education, training, and technology transfer needs for current members of the metalcasting workforce, as well as metalcasting customers and university and high school students, are shown in Exhibit 6-2.

The metalcasting industry has identified a number of training methods that could be used to effectively educate its **existing workforce**. These include increased in-house education and training programs, self-directed programs using video/audio tapes and computer-assisted instruction, in-plant programs, and other "close to the site" alternatives such as Optic Link Tutorials. The industry associations have already begun to test some of these methods, and initial assessments suggest that many of them will soon be an integral part of the education process in the metalcasting industry.

The technology transfer process can also be enhanced through the use of electronic bulletin boards, on-line data bases, and communication networks. The coordination of these efforts with small foundries would allow these foundries to access information on technology currently being utilized. The ability to access technology at the foundry in "real time" will help foundries to immediately solve problems. For example, a foundry could conduct a literature search using a computerized abstract service that is modemed to the computer at the foundry. Though highly effective in concept, there are many problems in perception and skill among the users that will need to be addressed to assure that these mechanisms are utilized optimally.

In addition to developing new methods, current information transfer methods must be studied to improve their ability to deliver the needed information to the industry. Trade journals, continuing education programs, and conferences are all established methods that need to be reviewed and improved for added effectiveness. Refocusing and updating these information sources is critical to all metalcasters. Smaller companies could build a consortium that can share costs and staff for common areas of information transfer (see Section 8, Partnerships and Collaborations).

Exhibit 6-2. Human Resources Needs			
Existing Industry Workforce	Casting Designers and Customers	University Students	High School Students
Continue testing new training methods <ul style="list-style-type: none"> <li>- in-house education</li> <li>- self-directed programs using video/audio tapes and computer-assisted instruction</li> <li>- optic link tutorials</li> </ul> Develop electronic bulletin boards, on-line databases, and communication networks Develop ability to access technology at the foundry in real time Improve the ability of current information transfer methods Build a technology transfer consortium of smaller companies	Improve the perception of the quality, lead time, and applications of castings by designers and purchasers Increase marketing and promotional programs to existing and potential customers Develop technical and performance standards Educate customers about the true costs of cast components Familiarize customers with the advantages of using castings	Make more research funds available to conduct industry research Support cooperative education programs for undergraduate students	Create apprenticeship programs Work with local schools to inform them of industry's basic requirements Become a resource to local schools

The perception of the quality, lead time, and applications of castings by **designers and purchasers** must be improved (see Sections 2, 3, and 4). Much of the information and design data that designers have on castings are incomplete or inaccurate. To remedy these problems, the metalcasting industry will need to increase its marketing and promotional programs to its current customers as well as potential customers. Technical and performance standards (discussed in Section 3) will need to be written and distributed to designers of castings. A national communication system could possibly be developed to link component designers throughout manufacturing with design information on castings.

Since today's customer is looking for higher quality products with better service at lower costs, it is imperative that customers be educated about the true costs of cast components. Such costs include the customer's internal costs (i.e., machining, painting, etc.) as well as the initial cost of the component. Customers must also be familiarized with the advantages of using metal castings versus other processes, advantages such as weight reduction, cost reductions through better castings designs, and reproducibility with reliability.

If more research funds were available to conduct industry research, then more **college students** would be graduating with a better appreciation and understanding of the metalcasting industry (see Section 7, Profitability and Industry Health). Additionally, industry needs to support cooperative education programs for undergraduate students. This would expose the individual to the industry and the company to the abilities of the individual.

The metalcasting industry needs to create apprenticeship programs to gain interest in the industry on the part of **high school or vocational school students**. The industry will need to accept that remedial education and training will be its responsibility to provide to many new employees. Metalcasting companies will need to work with local schools to inform them of industry's basic requirements for graduating students. In some areas, metalcasters will need to become a resource to the schools. This will require increased partnering with state and local government agencies for assistance and support (see Section 8).